1.

11 The box shown has a weight of 15 N.

Force = M × g
= 15 N

① P = $\frac{F}{A}$

A = 0.2 × 0.3
= 0.06 m²

P = $\frac{15 N}{0.06 m^2}$
= 250 N/m²

② P = $\frac{15 N}{0.5 \times 0.2}$
= 150 N/m²

Pressure change
= 250 − 150
= 100 N/m²

0.30 m

0.20 m ①

0.50 m ②

face Q

face P

The box is resting on a horizontal surface with face P in contact with the surface.

What is the change in pressure on the surface if the box falls over onto face Q?

A 0.0040 m²/N **B** 0.0067 m²/N **C** 100 N/m² **D** 250 N/m²

2.

The diagram shows a simple mercury barometer.

Which length is used to indicate atmospheric pressure in a simple mercury barometer?

vacuum

A

C ✓

B

D
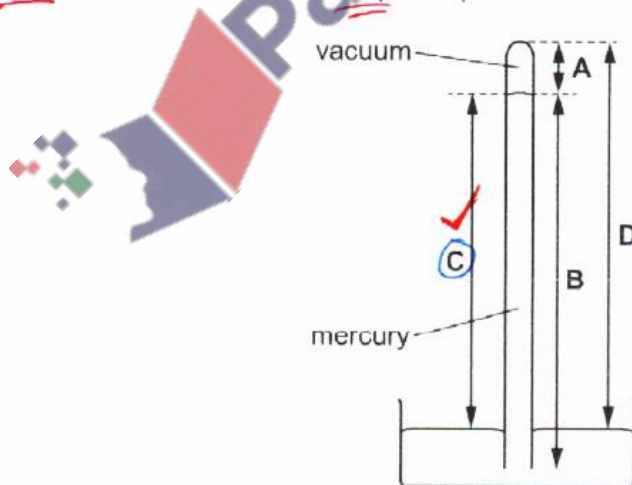
mercury

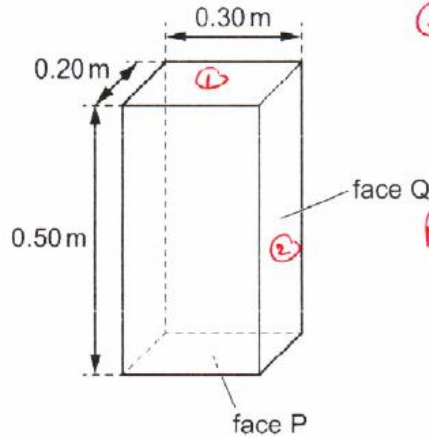Atm. pressure = to the height of mercury column from the surface of mercury in the trough.

3. Nov/2021/QPaper_13/No.11

Liquid is stored in a tank. The area of the base of the tank is 2.2 m² and the pressure at the base due to the liquid is 15 000 Pa.

What is the weight of the liquid?

A 3300 N   B 6800 N   C 15 000 N   D 33 000 N ✓

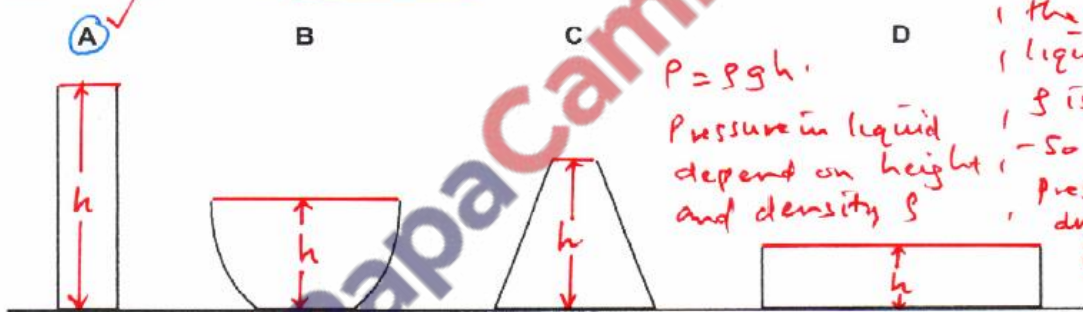$P = \dfrac{F}{A}$

$F = \text{weight}$

$F = P \times A$

$= 15000 \, Pa \times 2.2 \, m^2$

$= 33{,}000 \, N$

4. Nov/2021/QPaper_21/No.11

Four containers are filled to the top with the same liquid. The base of each container is circular.

Which container has the greatest pressure exerted by the liquid at its base?

A ✓   B   C   D

$P = \rho g h$

Pressure in liquid depend on height and density ρ

Since its the same liquid, the ρ is same. So more pressure is due to height.
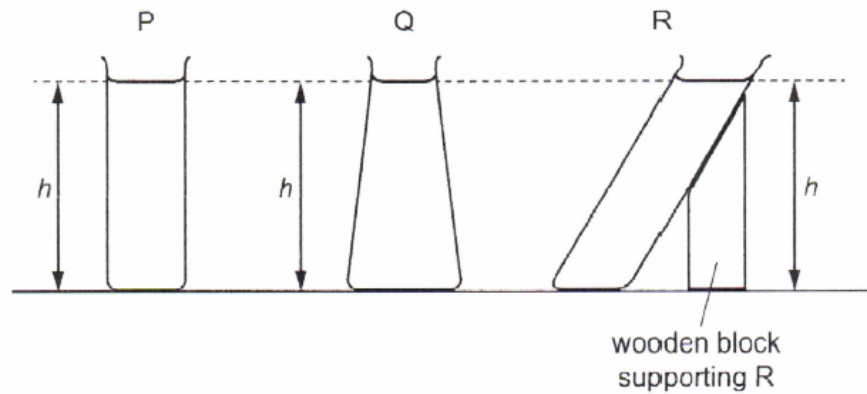
5. Nov/2021/QPaper_22/No.11

Which equation can be used to calculate the pressure at a depth h beneath the surface of a liquid?

$P = \rho g h$ ρ - density   g - gravity

A $p = \dfrac{h}{\rho g}$ B $p = \dfrac{h\rho}{g}$ C $p = h\rho g$ ✓   D $p = \dfrac{1}{h\rho g}$

2

The diagram shows three glass containers.

All three contain water filled to the <u>same vertical height</u> *h*.

P   Q   R

h   *h*   *h*

wooden block
supporting R

The base area of P is equal to the base area of R.

The base area of Q is larger than the other two.

Students are asked to compare the water pressure at the bottom of each container.

     Student 1 says that the pressure at base R is more than the pressure at base P.

     Student 2 says that the pressure at base Q is less than the pressure at base P.

     Student 3 says that the pressures at all three bases are the same. ✓

Which students are correct?

A   none are correct

B   1 only

C   2 only

D   3 only

Handwritten annotations:

Pressure in liquids does not depend on area of base.

$P = \rho g h$.

g - gravity
ρ - density
h - height

- So pressure is same on all 3 bases.

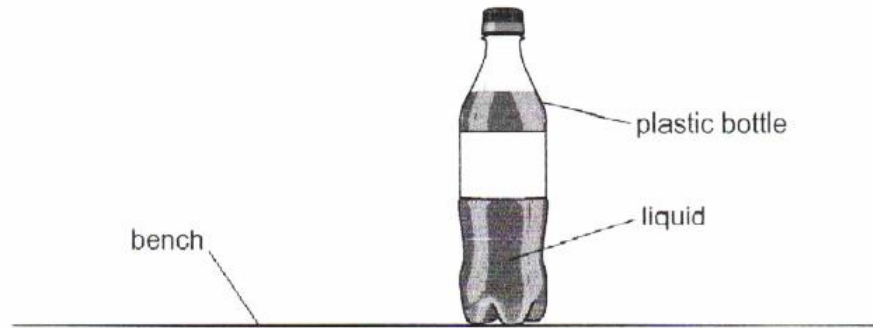Fig. 5.1 shows a plastic bottle on a bench. The plastic bottle contains a liquid.

Fig. 5.1

(a) The weight of the bottle and liquid is 12 N. The area of the bottle in contact with the bench is 25 cm².

Calculate the pressure of the bottle on the bench.

$p = \dfrac{F}{A}$

$= \dfrac{12N}{25 cm^2} = 0.48 \, N/cm^2$

pressure on bench = ...0.48...... N/cm² [3]

(b) A student pours out all the liquid from the bottle. She then connects the bottle to a vacuum pump which removes most of the air from the bottle. Fig. 5.2 shows the bottle after most of the air is removed.
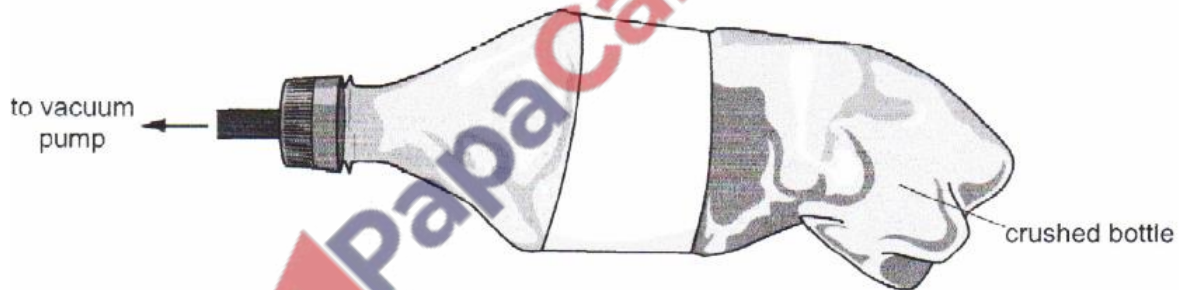

to vacuum pump

crushed bottle

Fig. 5.2

Explain why the bottle is crushed. Use your ideas about molecules.

— There are fewer molecules inside the bottle.
— The molecules of air move at high K·E
— They collide with walls of the plastic bottle.
— This causes force to act per unit area causing pressure
— The pressure outside is greater than the pressure inside the bottle, so it crushes. [4]

[Total: 7]

(a) A teacher wants to measure the mass of a block of metal. She also wants to measure the length, width and height of the block.
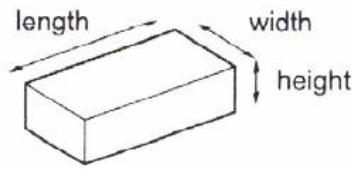
Fig. 4.1 shows the block of metal.

balance
— electroni }
— beam } *balances.*
— Top pan }

Fig. 4.1

Complete each sentence using a word from the list.

balance ✓   **barometer**   **protractor**   **ruler** ✓   **voltmeter**

(i) To find the mass of the metal block, the teacher uses a ....*balance*........... [1]

(ii) To measure the length, width and height of the metal block, she uses a ......*ruler*...... [1]

(b) The mass of the block is 5000 g.

$\frac{5000g}{1000} = 5kg$

Calculate the weight of the block.

$W = m \times g$, $g = 10\,m/s^2 (or\ N/kg).$

$\therefore W = 5kg \times \frac{10N}{kg}$

$= 50N$

weight = ...50........... N [3]
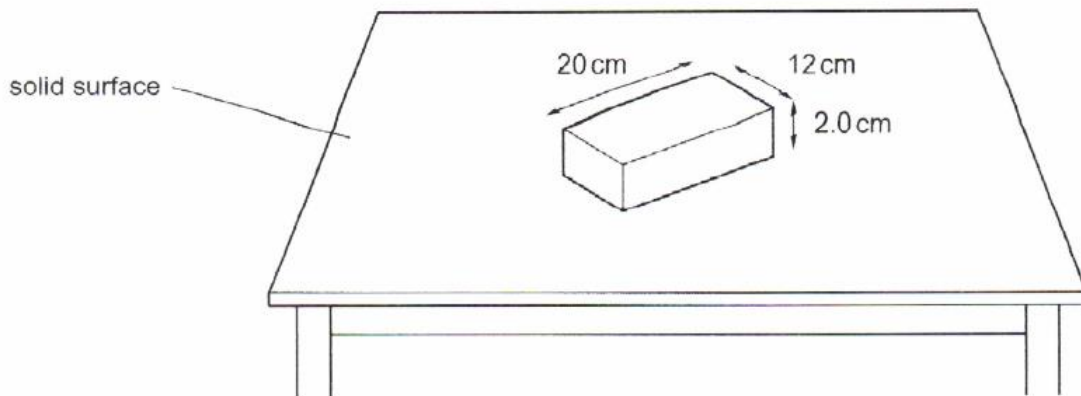
(c) Fig. 4.2 shows another block of metal on a solid surface.

Fig. 4.2 (not to scale)

(i) Calculate the area of the block of metal in contact with the solid surface.

$$Area = l \times w$$
$$= 20cm \times 12cm$$
$$= 240cm^2$$

area = ...**240**............... cm^2 [1]

(ii) The weight of the block of metal in Fig. 4.2 is 60N.

Calculate the pressure of the block of metal on the solid surface.

$$P = \frac{F}{A}.$$
$$= \frac{60N}{240cm^2}$$
$$= 0.25 N/cm^2$$

pressure = ...**0.25**............... N/cm^2 [3]

[Total: 9]

(a) A gas bubble is released at the bottom of a lake.

Atmospheric pressure is 1.0×10^5 Pa. The density of water is $1000 \, kg/m^3$. The temperature of the water in the lake is constant.

(i) The gas bubble rises to the surface. The volume of the gas bubble increases as it rises higher in the water.

Explain why the volume of the bubble increases.

— Pressure decreases as the bubble rises.
— Since pressure is inversely proportional to volume at constant temp, the volume will increase. [2]

(ii) The volume of the gas bubble is $0.40 \, cm^3$ when it is 3.0 m below the surface of the lake.

Calculate the volume of the gas bubble when it is 0.50 m below the surface of the lake.

$\rho = 1000 \, kg/m^3$

$P = \rho g h.$

At 3.0 m

$P = 1000 \times 10 \times 3$
$= 30,000 \, Pa + 1.0 \times 10^5$
$= 130,000 \, Pa$

At 0.5 m

$P = 1000 \times 10 \times 0.5$
$= 5000 \, Pa + 1.0 \times 10^5$
$= 105,000 \, Pa$

$P_1 V_1 = P_2 V_2$

$V_1 = 0.4 \, cm^3$
$P_1 = 130000 \, Pa$
$V_2 = ?$
$P_2 = 105,000 \, Pa$

$V_2 = \dfrac{P_1 V_1}{P_2}$

$= \dfrac{130,000 \times 0.4}{105,000}$

$= 0.495 \, cm^3$

$0.495 \, cm^3$

$\approx 0.5 \, cm^3.$

volume = ... $0.5 \, cm^3$ .... [4]

(b) Fig. 3.1 shows a diagram of a hydraulic press used to compress paper for recycling.
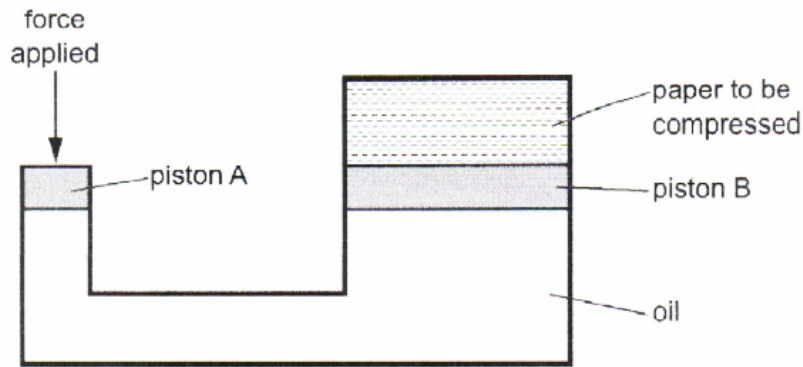

Fig. 3.1

When a force is applied to piston A, it causes a pressure in the oil. This pressure produces an upwards force on piston B. As piston B moves, it compresses the paper.

A small quantity of air leaks into the oil.

Suggest and explain the effect the air has on the operation of the hydraulic press.

- Piston B will have less force
- Air can be compressed so some energy is used to compress air instead of compressing the paper.

[2]

[Total: 8]